

REMARKS

Claims 1, 5, 17, 20, 30 and 33 have been amended. Claims 1-240 remain pending. Claims 51-234 and 236-240 have been withdrawn from consideration as to non-elected inventions. Applicant reserves the right to pursue the original claims and other claims in this and other applications. Applicant respectfully requests reconsideration of the above-referenced application in light of the amendments and following remarks.

The drawings stand objected to under 37 C.F.R. § 1.121(d) because they are not legible. The objection is respectfully traversed. A Submission of Replacement Sheets of Drawings (FIGS. 1-10) is being concurrently filed herewith. The drawings are in full compliance with 37 C.F.R. § 1.121(d) and the objection should be withdrawn.

Claims 17, 20 and 33 stand objected to because of informalities. The objection is respectfully traversed. Claims 17, 20 and 33 have been amended in accordance with the Office Action's recommendations. Consequently, the objections of these claims should be withdrawn.

Claims 30-37, 40-44, 46-50 and 235 stand rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. patent application publication no. 2004-0173799 ("Patrick"). The rejection is respectfully traversed.

Patrick does not disclose a photoconversion device comprising, *inter alia*, "a substrate having a surface; a first region doped . . . a second undoped region laterally adjacent to said first doped region; and a third region doped . . . beneath said first doped region for collecting photogenerated charges," as recited in claim 30 (emphasis added).

Similarly, Patrick does not teach a photoconversion device comprising, *inter alia*, “a substrate having a surface; a first region . . . having a dopant gradient profile; a separation region; and a second region doped . . . located *beneath* said first doped region and separation region for collecting photogenerated charges,” as recited in claim 235 (emphasis added).

Patrick discloses a dopant gradient region 275 (FIG. 19). The dopant gradient region 275 comprises a first sub-region 260 and laterally adjacent second sub-region 270. Both sub-regions 260 and 270 are *doped* regions formed underneath a transfer gate 130 (FIG. 19). The “dopant concentration in the first doped region 260 (FIG. 18) is decreased compared to the dopant concentration of the second doped region 270.” (§ 78). The dopant gradient region 275 is laterally adjacent to a pinned photodiode 299 comprising a pinned surface layer 288 and charge collection region 226.

Patrick does *not* teach a second *undoped* region formed laterally adjacent to a first doped region with a third doped region formed *beneath the first doped region*, much less a second doped region that collects photogenerated charge beneath a separation region and a first doped region comprising a doping gradient profile. Patrick’s charge collection region 226 is merely formed underneath a pinned surface layer 288. It is *not* formed *underneath* a separation region, a first doped region comprising a doping gradient profile, or an undoped region.

Claims 31-37, 40-44 and 46-50 depend from claim 30 and should be similarly allowable along with claim 30 for at least the reasons provided above. For at least these reasons, the § 102(e) rejection of claims 30-37, 40-44, 46-50 and 235 should be withdrawn.

Claims 1-6, 12, 17-22, 24, 25, 28-34, 40-43, 45, 46, 49, 50 and 235 stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. patent application publication no. 2002-0047115 ("Kawakami"). The rejection is respectfully traversed.

Kawakami does not disclose a photoconversion device comprising, *inter alia*, "a substrate having a surface; a first region doped to a first conductivity type . . . having a graded profile, *wherein said region has a higher dopant concentration near the surface of the substrate*; and a second region doped to a second conductivity type located beneath said first doped region for collecting photogenerated charges," as recited in claim 1 (emphasis added).

Kawakami does not disclose a photoconversion device comprising, *inter alia*, "a substrate having a surface; a first region doped . . . *a second undoped region laterally adjacent to said first doped region*; and a third region doped . . . beneath said first doped region for collecting photogenerated charges," as recited in claim 30 (emphasis added).

Similarly, Kawakami does not teach a photoconversion device comprising, *inter alia*, "a substrate having a surface; a first region . . . having a dopant gradient profile; *a separation region*; and a second region doped . . . located *beneath* said first doped region and separation region for collecting photogenerated charges," as recited in claim 235 (emphasis added).

Kawakami discloses, in FIGS. 58A-58E, a photoresist film 322 formed on substrate 301. In substrate 301, a first n-type region 333 is formed laterally adjacent to second n-type regions 332. A p-type layer 304 is formed over the n-type regions 332, 333. Channel stop regions 305 are formed laterally adjacent to the p-type layer 304 and n-type regions 332, 333.

Kawakami does not teach a first doped region with a graded profile, wherein the first doped region *itself* has a higher dopant concentration near the surface of a substrate as claim 1 recites. Applicant's claimed first doped region has a higher concentration of dopants near the surface of a substrate. Kawakami merely discloses two laterally adjacent doped regions, *i.e.*, p-type layer 304 and p-type channel stop regions 305. Kawakami does *not* teach that the p-type layer 304 *itself* has a gradient profile.

Kawakami does not disclose a second *undoped region* laterally adjacent to a first doped region as claim 30 recites, much less a separation region as claim 235 recites. Applicant's claimed structure comprises a first doped region 104a laterally adjacent to an undoped region 171, *i.e.*, a separation region, which are formed above another doped region 135 that collects photogenerated charges. Kawakami does not teach an undoped region much less a separation region that is *laterally* adjacent to a doped region. At best, Kawakami's oxide layer 313 is formed *on top* of p-type layer 104 and channel stoppers 305.

Claims 2-6, 12, 17-22, 24, 25, and 28-29 depend from claim 1 and should be similarly allowable along with claim 1 for at least the reasons provided above. Claims 31-34, 40-43, 45, 46, and 50 depend from claim 30 and should be similarly allowable along with claim 30 for at least the reasons provided above. For at least these reasons, the § 102(b) rejection of claims 1-6, 12, 17-22, 24, 25, 28-34, 40-43, 45, 46, 49, 50 and 235 should be withdrawn.

Claims 7-11, 13-16, 23, 26, 27, 35-39, 44, 47 and 48 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Kawakami. The rejection is respectfully traversed.

Claims 7-11, 13-16, 23, 26, 27 depend from claim 1 and should be similarly allowable along with claim 1 for at least the reasons provided above with regard to claim 1. Claims 35-39, 44, 47 and 48 depend from claim 30 and should be similarly allowable along with claim 30 for at least the reasons provided above with regard to claim 30.

Specifically, Kawakami does not teach or suggest a first doped region with a graded profile, wherein the first doped region *itself* has a higher dopant concentration near the surface of a substrate. Kawakami does *not* teach or suggest that the p-type layer 304 *itself* has a gradient profile. Similarly, Kawakami does not disclose or suggest a second *undoped region laterally adjacent* to a first doped region as claim 30 recites. At best, Kawakami's oxide layer 313 is formed *on top* of p-type layer 104 and channel stoppers 305. For at least these reasons, the § 103(a) rejection of claims 7-11, 13-16, 23, 26, 27, 35-39, 44, 47 and 48 should be withdrawn.

The Office Action acknowledges that Kawakami does *not* disclose or suggest Applicant's claimed dopant concentrations; but, concludes that it would have been a matter of routine optimization to apply Applicant's claimed dopant concentrations (p. 14). Applicant respectfully submits that the Office Action fails to set forth a *prima facie* case of obviousness. See M.P.E.P. § 2142.

In particular, Kawakami does *not* teach or suggest Applicant's claimed implant doses for forming the various doped regions. To establish *prima facie* obviousness of a claimed invention, *all* the claim limitations must be taught or suggested *by the prior art.*" M.P.E.P. § 2143.03 (emphasis added). It is *inappropriate* to merely conclude that these parameters can be determined through routine optimization. Kawakami must teach or suggest Applicant's claimed implant doses for a *prima facie* case of obviousness.

As such, Kawakami does not disclose or suggest a "first dopant concentration [which] is from about $2.0 \times 10^{12}/\text{cm}^2$ to about $1.0 \times 10^{14}/\text{cm}^2$," as recited in claim 7, a "first dopant concentration [which] is from about $6.0 \times 10^{12}/\text{cm}^2$ to about $5.0 \times 10^{13}/\text{cm}^2$," as recited in claim 8, a "second dopant concentration [which] is from about $1.0 \times 10^{12}/\text{cm}^2$ to about $6.0 \times 10^{13}/\text{cm}^2$," as recited in claim 9, or a "second dopant concentration [which] is from about $3.0 \times 10^{12}/\text{cm}^2$ to about $4.0 \times 10^{13}/\text{cm}^2$," as recited in claim 10.

Similarly, Kawakami does not teach or suggest a "first dopant concentration [which] is from about $2.0 \times 10^{12}/\text{cm}^2$ to about $1.0 \times 10^{14}/\text{cm}^2$," as recited in claim 36, or a "first dopant concentration [which] is from about $6.0 \times 10^{12}/\text{cm}^2$ to about $5.0 \times 10^{13}/\text{cm}^2$," as recited in claim 37. These are additional reasons for the allowance of dependent claims 7-10 and 36-37.

In view of the above, each of the presently pending claims in this application is believed to be in immediate condition for allowance. Accordingly, the Examiner is respectfully requested to review and pass this application to issue.

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Respectfully submitted,

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